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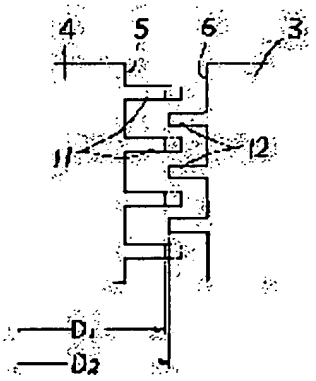
(54) SEAL STRUCTURE OF ROTATING MEMBER AND ASSEMBLING METHOD AND SEALING METHOD THEREOF

(57)Abstract:

PURPOSE: To provide the seal structure, which can obtain the excellent labyrinth effect easily between the opposing outer peripheral surface of one member and the opposing inner peripheral surface of the other member and which can seal a clearance in the axial direction of both the members, and assembling method and sealing method thereof.



CONSTITUTION: A first and a second annular sealing projections 11, 12 are provided alternately in the opposing outer peripheral surface 5 of a rotating member 4 and the opposing inner peripheral surface 6 of a stationary member 3, and the outer diameter D1 of the first sealing projection 11 projecting from the outer peripheral surface 5 of the rotating member 4 is formed smaller than the inner diameter D2 of the second sealing projection 12 projecting from the inner peripheral surface 6 of the stationary member 3. One of both members 3, 4, which has the opposing inner peripheral surface 6, is made of the material having a coefficient of thermal expansion smaller than that of the other member, and respective sealing projections 11, 12 are lapped over each other by the temperature rise at the time of operation to seal a clearance in the axial direction surely and excellently.

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CLAIMS

[Claim(s)]
[Claim 1] It is the seal structure of the revolution member 4 which counters the quiescence flank material 3 and is rotated. While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 Seal structure of the revolution member characterized by forming with the ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3 on the other hand.
[Claim 2] It is the seal structure of the revolution member 4 which counters the quiescence flank material 3 and is rotated. While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 Seal structure of the revolution member characterized by having established a cooling means with said opposite inner skin 6 to cool this member 3 or 4 to a member 3 or 4 on the other hand.
[Claim 3] While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which the quiescence flank material 3 and the revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 Seal structure of the revolution member which forms with an ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3, and is characterized by having established said cooling means to cool this member 3 or 4 to a member 3 or 4 on the other hand.
[Claim 4] With the seal structure of the revolution member 4 which counters the quiescence flank material 3 by fit-in at ** with a group, and said quiescence flank material 3, and is rotated While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency It is the approach with a group of the seal structure which made the major diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6. The cooling processing which had said opposite peripheral face 5 at the time of fit-in to the quiescence flank material 3 of said revolution

member 4 and which, on the other hand, cools a member 4 or 3, The approach with a group of the seal structure characterized by performing one side with the heat-treatment which heats the another side member 3 with said opposite inner skin 6, or 4, or both processing, and carrying out the lap of the 1st seal projection 11 of the fit-in backward above, and the 2nd seal projection 12.
[Claim 5] It is the seal approach of the revolution member 4 which counters the quiescence flank material 3 and is rotated. While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 On the other hand, it forms with an ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3. The seal approach of the revolution member characterized by carrying out the lap of said 1st seal projection 11 and 2nd seal projection 12 by the temperature rise produced at the time of the revolution of said revolution member 4.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is applied between Rota by which a high-speed revolution is carried out to the stator and this stator of a vacuum pump about the seal approach at the seal structure of the revolution member which counters quiescence flank material and is rotated, and its approach list with a group.
[0002]
[Description of the Prior Art] Conventionally, what was applied to the vacuum pump is indicated by JP,63-54888,U as seal structure of a revolution member over quiescence flank material. As drawing 4 showed, while a thing given [this] in an official report establishes Rota C which counters Stator B and this stator B and is rotated in the interior of the casing A with an inlet port and an exhaust port By carrying out interlocking connection of the Rota shaft E prolonged from Motor D in this Rota C, and carrying out the high-speed revolution of said Rota C with the actuation revolution of this shaft E While making as [perform / vacuum suction of the vacuum chamber which exhausts towards an exhaust port from the inlet port of said casing A, and is connected to said inlet port] In order to prevent that it is open for free passage the motor housing G side to which the flueway F formed between said Stators B and Rota C carries out the inner package of said motor D, Two or more annular seal projections I which project towards this shaft E side are formed in an opposite part with said shaft E in the shaft bearing room H. He carries out the seal of the shaft-orientations clearance between said motor housing G and said flueways F, and is trying to prevent the leakage in exhaust air from this flueway F to the motor housing G side according to the labyrinth effectiveness produced between this shaft E and said projection I at the time of the revolution of said shaft E.
[0003]
[Problem(s) to be Solved by the Invention] by the way, generally, in order to carry out a seal certainly and good, the shaft-orientations clearance between quiescence flank material and the revolution member by which is fitted in this quiescence flank material in the shape of opposite, and revolution actuation is carried out A seal projection respectively annular in the shape of an inconsistency is formed in the opposite inner skin and the opposite peripheral face of said both members. It is desirable to carry out the lap of this each seal projection mutually, by ****(ing), at the time of the revolution to the quiescence flank material of said revolution member, the labyrinth effectiveness good between the opposite inner skin and opposite peripheral face is acquired, and the certain and good seal between both [these] members becomes possible.
[0004] According to the labyrinth effectiveness which a place forms two or more seal projections I to which it projects towards said shaft E in the above conventional vacuum pump only in one side of said shaft bearing room H, and produces between this each projection I and said shaft E Since it was considering as the structure which carries out the seal of the shaft-orientations clearance between said Flueways F and said motor housing G, the good labyrinth effectiveness was not acquired, and a seal could not be carried out certainly, either, but the leakage in exhaust air from said flueway F occurred, and there was a problem of pump efficiency falling. in addition, as mentioned above, in order to acquire the good labyrinth effectiveness between said quiescence flank material and revolution members

Although it is necessary to carry out the lap of each [these] seal projection mutually as a major diameter at the time of assembly from the bore of the seal projection which protrudes on the opposite inner skin of said quiescence flank material the outer diameter of the seal projection which protrudes on the opposite peripheral face of this revolution member Thus, when the seal projection which carries out a lap mutually was beforehand formed in the opposite inner skin and the opposite peripheral face of said both members, with the conventional technique with a group, by existence of said each seal projection, were able to fit in said both members and they were not able to be attached. Moreover, in order to acquire the labyrinth effectiveness ideal between said quiescence flank material and revolution members Although attaching said each division member in the shape of a laminating is also considered dividing both [these] members in the die-length direction at plurality, respectively, preparing said seal projection which carries out a lap to this division member mutually at the time of with a group, respectively, and carrying out the lap of each [these] seal projection mutually When ****(ing), the activity with a group with said quiescence flank material and revolution member became very complicated, and, moreover, it was easy to generate fluid leakage from the laminating clearance between each division member in both [these] members, and was not able to adopt from it being technically difficult to prevent this fluid leakage.

[0005] This invention is what was made in view of the above problems, and the object is in being able to acquire the good labyrinth effectiveness easily between the opposite inner skin of said quiescence flank material and revolution member, and an opposite peripheral face, and providing with the seal approach the seal structure which can carry out the seal of the shaft-orientations clearance between both [these] members certainly and good, and its approach list with a group, without using quiescence flank material and a revolution member as a rate form.

[0006]

[Means for Solving the Problem] In the seal structure of the revolution member 4 which the 1st invention counters the quiescence flank material 3, and is rotated in order to attain the above-mentioned object While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 On the other hand, it formed with the ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3.

[0007] In the seal structure of the revolution member 4 which the 2nd invention counters the quiescence flank material 3, and is rotated While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into the minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6, on the other hand, a cooling means with said opposite inner skin 6 to cool this member 3 or 4 to a member 3 or 4 was established.

[0008] While the 3rd invention forms the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which the quiescence flank material 3 and the revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 On the other hand, it formed with the ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3, and said cooling means to cool this member 3 or 4 to a member 3 or 4 was established.

[0009] The 4th invention is the seal structure of the revolution member 4 which counters the quiescence

flank material 3 by fit-in at ** with a group, and said quiescence flank material 3, and is rotated. While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency In the approach with a group of the seal structure which made the major diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 The cooling processing which had said opposite peripheral face 5 at the time of fit-in to the quiescence flank material 3 of said revolution member 4 and which, on the other hand, cools a member 4 or 3, One side with the heat-treatment which heats the another side member 3 with said opposite inner skin 6 or 4, or both processing is performed, and it was made to carry out the lap of the 1st seal projection 11 of the fit-in backward above, and the 2nd seal projection 12.

[0010] In the seal approach of the revolution member 4 which the 5th invention counters the quiescence flank material 3, and is rotated While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 On the other hand, it forms with an ingredient with a small coefficient of thermal expansion to the another side member 4 with said opposite inner skin 6 which had said opposite peripheral face 5 for a member 3 or 4, or 3. It was made to carry out the lap of said 1st seal projection 11 and 2nd seal projection 12 by the temperature rise produced at the time of the revolution of said revolution member 4.

[0011]

[Function] With the seal structure of the 1st invention, to the opposite peripheral face 5 and the opposite inner skin 6 of said quiescence flank material 3 and revolution member 4 which counter mutually The respectively annular 1st and 2nd seal projections 11 and 12 protrude in the shape of an inconsistency. Since the outer diameter D1 of this 1st seal projection 11 is made into a minor diameter from the bore D2 of the 2nd seal projection 12 and a member 3 or 4 is formed with the ingredient with a small coefficient of thermal expansion to the another side member 4 or 3 on the other hand among said both members, Although the aforementioned one side member 3, 4 and said another side member 4, or 3 causes thermal expansion by the temperature rise at the time of operation, respectively On the other hand by the member 3 or 4, said thermal expansion by the temperature rise cannot happen easily. On the other hand By said another side member 4 or 3 side, thermal expansion will happen, the diameter of said 1st seal projection 11 will be expanded to said 2nd seal projection 12, and the lap of these 1st and 2nd seal projections 11 and 12 is mutually carried out to this one side member 3 or 4. Therefore, a big clearance is secured between the opposite peripheral face 5 of said quiescence flank material 3 and said revolution member 4, and the opposite inner skin 6. Being able to prevent contacting said quiescence flank material 3 at the time of the revolution of this revolution member 4 It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually, the good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between both [these] the members 3 and 4 can be carried out certainly and good.

[0012] With the above structure, moreover, the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 Rather than the bore D2 of the 2nd seal projection 12 prepared in the opposite inner skin 6 of said quiescence flank material 3, by the temperature rise under a minor diameter, nothing, and operation by [said] on the other hand making said another side member 4 or 3 expand thermally to a member 3 or 4 Since the lap of said 1st and 2nd seal projections 11 and 12 is carried out mutually and he is trying to acquire the good labyrinth effectiveness between the opposite peripheral face 5 of said both members 3 and 4, and the opposite inner skin 6, When [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, Without checking

said another side [as opposed to a member 3 or 4 on the other hand] member 4, or fit-in of 3, said each seal projections 11 and 12 can perform certainly and easily this one side member 3, the another side member 4 of 4, or fit-in of 3, and can also do an activity with a group easily. Furthermore, in the above invention, said quiescence flank material 3 and revolution member 4 are divided in the die-length direction at plurality, respectively, and although the lap of the seal projection which prepared each of this division member in this each division member in the shape of a laminating at the time of assembly is carried out mutually, an activity with a group is not complicated like, and fluid leakage does not occur from the laminating clearance between said each division member.

[0013] Since [which had opposite inner skin among said both members] the cooling means is formed in a member 3 or 4 on the other hand, with the seal structure of the 2nd invention at the time of operation By [said] on the other hand cooling a member 3 or 4, this one side member 3 or the thermal expansion of 4 is controlled with this cooling means. In said another side member 4 or 3 side Since thermal expansion happens by the temperature rise at the time of operation, these one side member 3, 4 and the another side member 4, or the big differential thermal expansion between 3 occurs. While the big clearance which may be made to carry out the lap of said each seal projections 11 and 12 certainly mutually, therefore does not contact between said quiescence flank material 3 and revolution members 4 is securable It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out much more certainly and good. And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of the 1st invention mentioned above, Without said each seal projections 11 and 12 checking fit-in, when [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, the aforementioned one side member 3, the another side member 4 of 4, or fit-in of 3 can be performed certainly and easily, and an activity with a group can also be done easily.

[0014] With the seal structure of the 3rd invention, on the other hand, while forming with an ingredient with a small coefficient of thermal expansion to the another side member 4 which had opposite inner skin among said both members and which had the opposite peripheral face 5 for a member 3 or 4, or 3 Since [with said opposite inner skin 6] the cooling means is formed in a member 3 or 4 on the other hand, at the time of operation With this cooling means, since [said] a member 3 or 4 is cooled on the other hand and a member 3 or 4 is moreover formed with this ingredient with a small coefficient of thermal expansion on the other hand, This one side member 3 or the thermal expansion of 4 is controlled much more good. In said another side member 4 or 3 side Since thermal expansion happens by the temperature rise at the time of operation, these one side member 3, 4 and the another side member 4, or the big differential thermal expansion between 3 occurs. While the big clearance which may be made to carry out the lap of said each seal projections 11 and 12 certainly mutually, therefore does not contact between said quiescence flank material 3 and revolution members 4 is securable It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out much more certainly and good. And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of each invention mentioned above When [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, said each seal projections 11 and 12 cannot check fit-in, the aforementioned one side member 3, the another side member 4 of 4, or fit-in of 3 can be ensured, and an activity with a group can also be done easily.

[0015] Although the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the major diameter by the approach with a group of the seal structure concerning the

4th invention rather than the bore D2 of the 2nd seal projection 12 prepared in said opposite inner skin 6 While it had the opposite peripheral face 5 among both [these] members at the time of fit-in to the quiescence flank material 3 of said revolution member 4, cooling processing of a member 3 or 4 is carried out. Or the another side member 4 with the opposite inner skin 6 or 3 is heat-treated. By [said] on the other hand cooling and heat-treating a member 3, 4 and the another side member 4, or 3, respectively [both] The lap of said each seal projections 11 and 12 can be carried out easily mutually, following on these cooling processing or heat-treatment, and the diameter of said 1st seal projection 11 and 2nd seal projection 12 being reduced [the diameter of them] or expanded, respectively, and being able to perform simply the aforementioned one side member 3, the another side member 4 of 4, or the fit-in activity of 3. Therefore, like the case of each invention which was mentioned above also in this 4th invention, being able to do easily the fit-in activity over the quiescence flank material 3 of said revolution member 4, with the lap of said the seal projections 11 and 12 of each, the good labyrinth effectiveness is acquired between said opposite peripheral face 5 and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out certainly and good.

[0016] By the seal approach of the 5th invention, to said opposite peripheral face 5 and opposite inner skin 6 While protruding the respectively annular 1st and 2nd seal projections 11 and 12 in the shape of an inconsistency and making the outer diameter D1 of this 1st seal projection 11 into a minor diameter from the bore D2 of the 2nd seal projection 12 On the other hand, it forms with an ingredient with a small coefficient of thermal expansion to the another side member 4 which had the opposite inner skin 6 among said both members and which had the opposite peripheral face 5 for a member 3 or 4, or 3. In order to carry out the lap of said 1st seal projection 11 and 2nd seal projection 12 by the temperature rise produced at the time of the revolution of said revolution member 4, Like the case of each invention which was mentioned above also in this 5th invention, being able to do easily the fit-in activity over the quiescence flank material 3 of said revolution member 4 Said each seal projections 11 and 12 will carry out a lap at the time of operation. With this lap The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out certainly and good.

[0017]

[Example] Hereafter, the example of a drawing explains the seal approach to the seal structure and the approach list with a group of the revolution member concerning this invention. The vacuum pump used in order that drawing 3 may carry out vacuum suction of the semi-conductor manufacture room etc. as an example of application of this invention is shown, and this vacuum pump is carrying out the inner package of the vortex type pump element 2 to the way upper part side among the casing 1 equipped with inlet-port 1a and exhaust-port 1b. The opposite peripheral face 5 of said Rota 4 which this vortex type pump element 2 is equipped with the stator 3 which makes the shape of a cylindrical shape which is quiescence flank material, and tubed Rota 4 which is a revolution member, and counters at the time of fit-in to said stator 3 of this Rota 4, While making the opposite inner skin 6 by the side of said stator 3 approach mutually and fitting it in While forming two or more exhaust air passage 7 which changes from the annular semicircle slot opened to the inner direction to the opposite inner skin 6 of this stator 3, the semicircle-like reentrant 8 of a large number opened to the method of outside was formed in the opposite peripheral face 5 of said Rota 4, and the wing 81 which attends said exhaust air passage 7 at each of this reentrant 8 is formed.

[0018] Moreover, form a motor 9 in a way lower part side among said casing 1, and said Rota 4 is made to carry out interlocking connection of the Rota shaft 10 prolonged from this motor 9. The exhaust air to exhaust-port 1b of said casing 1 from inlet-port 1a is performed, and it is made to make said semi-conductor manufacture interior of a room connected to said inlet-port 1a by carrying out the high-speed revolution of said Rota 4 to said stator 3 by the revolution of the Rota shaft 10 accompanying said motor 9 into a vacuum.

[0019] The deer was carried out, and in carrying out the seal of between said stators 3 and Rota 4, in the

above vacuum pumps, the following seal structures were adopted by the 1st invention. Namely, the example which expanded to drawing 1 and was shown arranges said Rota 4 inside said stator 3. The 1st seal projection 11 which projects toward the opposite inner skin 6 of said stator 3 in vertical direction two or more parts, respectively by the opposite peripheral face 5 of this Rota 4 Moreover, while forming the 2nd seal projection 12 which projects toward the opposite peripheral face 5 of said Rota 4, respectively said the shape of the 1st seal projection 11 and an inconsistency in vertical direction two or more parts by the opposite inner skin 6 of said stator 3 While making the outer diameter D1 of this 1st seal projection 11 into a minor diameter from the bore D2 of said 2nd seal projection 12 Said stator 3 on which this 2nd seal projection 12 protrudes is formed with an ingredient with a small coefficient of thermal expansion to said Rota 4 where said 1st seal projection 11 protrudes. For example, said Rota 4 is formed for an aluminum raw material with a large coefficient of thermal expansion etc., and said stator 3 is formed for a nickel system alloy raw material with a coefficient of thermal expansion smaller than said aluminum etc.

[0020] And although said Rota 4 is made to fit in the interior of said stator 3 at the time of with [of the above vacuum pumps] a group Since the outer diameter D1 of said 1st seal projection 11 prepared in this Rota 4 side is made into the minor diameter at this time [bore / D2 / of said 2nd seal projection 12 prepared in said stator 3 side], In spite of having formed said 1st and 2nd seal projections 11 and 12 in these Rota 4 and a stator 3, without using said Rota 4 and stator 3 as a rate form Each [these] seal projections 11 and 12 can check fit-in, or smoothly, there are nothings, a fit-in activity into the stator 3 of said Rota 4 can be ensured, and an activity with a group can be done easily.

[0021] Moreover, although said stator 3 and the temperature of Rota 4 rise, respectively when operating the above vacuum pump Said stator 3 is formed for a nickel system alloy raw material with a small coefficient of thermal expansion etc. On the other hand, said Rota 4 from being formed for the aluminum raw material with a larger coefficient of thermal expansion than said stator 3 etc. By said stator 3 side, thermal expansion hardly happens to a big thermal expansion in said Rota 4 side happening by the temperature rise at the time of operation. This sake, The lap of said 1st and 2nd seal projections 11 and 12 is mutually carried out by the differential thermal expansion of said stator 3 and Rota 4, therefore a big clearance is secured between the opposite peripheral face 5 of said Rota 4 and stator 3, and 5 opposite inner skin 6. Preventing contacting said stator 3 at the time of a revolution of said Rota 4 It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said Rota 4 and stator 3, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between Rota 4 can be carried out to said stator 3 certainly and good.

[0022] In addition, although said stator 3 on which said 2nd seal projection 12 protrudes was formed for the nickel system alloy raw material with a small coefficient of thermal expansion etc. and said Rota 4 where said 1st seal projection 11 protrudes was formed for the aluminum raw material with a large coefficient of thermal expansion etc. in the above example In the structure of establishing said Rota 4 in the periphery section of said stator 3 With the case where it mentions above, conversely, while protruding said 1st seal projection 11 on said stator 3 Form said stator 3 for an aluminum raw material with a large coefficient of thermal expansion etc., and the 2nd seal projection 12 is made to protrude on said Rota 4, and also when said Rota 4 may be formed for a nickel system alloy raw material with a small coefficient of thermal expansion etc. and is ****(ed), the same operation effectiveness as the case where it mentions above is acquired.

[0023] In the 2nd invention, like the case of the 1st invention mentioned above to moreover, the opposite peripheral face 5 and the opposite inner skin 6 which were prepared in said Rota 4 and stator 3 and which counter mutually The 1st and 2nd seal projections 11 and 12 are formed in the shape of an inconsistency, respectively. the 1st seal projection 11 12 which protrudes on the opposite peripheral face 5, i.e., said 2nd seal projection which protrudes on the opposite inner skin 6 the outer diameter D1 of the 1st seal projection 11 which protrudes on the peripheral face of Rota 4 arranged inside said stator 3 in the example, -- that is While forming in a minor diameter rather than the bore D2 of the 2nd seal projection 12 which protrudes on the inner skin 6 of said stator 3, a cooling means is formed in said

stator 3 side.
[0024] As said cooling means, as drawing 3 showed, while forming the water cooling jacket 13 for the periphery of said stator 3 part between ********, this stator 3, and the wall of said casing 1, specifically, feed hopper 13a and exhaust port 13b of cooling water are prepared in this water cooling jacket 13, respectively.
[0025] And by circulating cooling water from said feed hopper 13a to exhaust port 13b through said water cooling jacket 13, and cooling said whole stator 3 at the time of operation, control the thermal expansion by the side of said stator 3, and the thermal expansion by the temperature rise at the time of operation is made to cause in said Rota 4 side, and a big differential thermal expansion is positively produced between said stators 3 and Rota 4. This differential thermal expansion will carry out the lap of said 1st and 2nd seal projections 11 and 12 more certainly. Then, this sake, While the big clearance which does not contact between the opposite peripheral face 5 of said Rota 4 and stator 3 and the opposite inner skin 6 is securable It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually, the good labyrinth effectiveness is acquired between said opposite peripheral face 5 and the opposite inner skin 6, and the seal of the shaft-orientations clearance between Rota 4 can be carried out to said stator 3 much more certainly and good. And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of the 1st invention mentioned above, Even if it does not use said Rota 4 and stator 3 as a rate form, when fitting in and attaching said Rota 4 to a stator 3, Without said each seal projections 11 and 12 checking fit-in, fit-in to the stator 3 of said Rota 4 can be ensured, and an activity with a group can also be done easily.
[0026] In addition, although carried out in the above example as [cool / said whole stator 3 / form said water cooling jacket 13 between said casing 1 and stators 3, and] The cooling means which changes from a water cooling jacket to the periphery side of said Rota 4 in the structure of establishing said Rota 4 in the periphery section of said stator 3 is established. At the time of operation, said Rota 4 side is cooled in this jacket, and it may be made to carry out the lap of said 1st and 2nd seal projections 11 and 12 by the differential thermal expansion of this Rota 4 and said stator 3 mutually.
[0027] furthermore, in the 3rd invention, like the case of the 1st and 2nd invention mentioned above To the opposite peripheral face 5 and the opposite inner skin 6 which were prepared in said stator 3 and Rota 4 and which counter mutually The 1st and 2nd seal projections 11 and 12 are formed in the shape of an inconsistency, respectively. The outer diameter D1 of the 1st seal projection 11 11, i.e., the 1st seal projection which protrudes on the peripheral face 5 of Rota 4 arranged inside said stator 3 in the example, which protrudes on the opposite peripheral face 5 While forming in a minor diameter rather than the bore D2 of said 2nd seal projection 12 12, i.e., the 2nd seal projection which protrudes on the inner skin 6 of said stator 3, which protrudes on the opposite inner skin 6 The one side of said stator 3 and Rota 4 is formed for a nickel system alloy raw material with a small coefficient of thermal expansion etc. Moreover, while forming the other side for the aluminum raw material with a large coefficient of thermal expansion etc., the cooling means which changes from said water cooling jacket 13 to the one side of said stator 3 and Rota 4 was established.
[0028] In the above invention [3rd] in said water cooling jacket 13 at the time of operation The inside in in said stator 3 and Rota 4, Since said stator 3 is cooled by the one side, i.e., an example, located outside and the one side of this stator 3 and Rota 4 is moreover formed for the nickel system alloy raw material with a small coefficient of thermal expansion etc., The thermal expansion of the one side of said stator 3 and Rota 4 is controlled much more good in the cooling operation by said jacket 13. Moreover, by the other side of said stator 3 and Rota 4, i.e., an example, since Rota 4 is formed for the aluminum raw material with a large coefficient of thermal expansion etc., a big thermal expansion will happen by the temperature rise at the time of operation. A big differential thermal expansion occurs between said stators 3 and Rota 4, and the lap of said 1st and 2nd seal projections 11 and 12 is mutually carried out certainly by these both differential thermal expansion. Therefore, this sake, While the big clearance which does not contact between said stators 3 and Rota 4 is securable It becomes possible to

carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said stator 3 and Rota 4, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between said stators 3 and Rota 4 can be carried out much more certainly and good.

[0029] And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of the 1st and 2nd invention mentioned above Even if it does not use said Rota 4 and stator 3 as a rate form, when fitting in and attaching said Rota 4 to a stator 3, said each seal projections 11 and 12 cannot check fit-in, fit-in to the stator 3 of said Rota 4 can be ensured, and an activity with a group can also be done easily.

[0030] Moreover, the 4th invention devises the approach with a group of of said Rota 4 and stator 3, is that to which it was made to carry out the lap of said 1st and 2nd seal projections 11 and 12, and explains the detail based on drawing 2 . Namely, it is what arranged said Rota 4 inside the stator 3 in the example shown in drawing 2 . While forming said 1st and 2nd seal projections 11 and 12 in the opposite peripheral face 5 and the opposite inner skin 6 of said Rota 4 and stator 3 in the shape of an inconsistency As I of drawing 2 showed, the outer diameter D1 of the 1st seal projection 11 which protrudes on the peripheral face 5 of Rota 4 When forming in the major diameter beforehand rather than the bore D2 of said 2nd seal projection 12 which protrudes on the inner skin 6 of a stator 3 and fitting in and attaching said Rota 4 to said stator 3, As cooling processing of said whole Rota 4 which protruded the 1st seal projection 11 is carried out and the continuous line of this drawing RO showed The diameter is made to reduce so that it may become a minor diameter from the bore D2 of the 2nd seal projection 12 which forms the outer diameter D1 of said 1st seal projection 11 in said stator 3, and Rota 4 which protruded said 1st seal projection 11 on the stator 3 which protruded this 2nd seal projection 12 is fitted in.

[0031] Therefore, by making said Rota 4 fit in into said stator 3 as mentioned above, as the dotted line of drawing 2 showed, the lap of said 1st seal projection 11 can be carried out to said 2nd seal projection 12.

[0032] According to the above approach with a group, the outer diameter D1 of the 1st seal projection 11 prepared in said Rota 4 By carrying out cooling processing of said Rota 4, and reducing the diameter of said 1st seal projection 11 at the time of fit-in into the stator 3 of said Rota 4, in spite of considering as the major diameter rather than the bore D2 of the 2nd seal projection 12 prepared in said stator 3 The fit-in activity to the stator 3 of said Rota 4 can be performed easily, and the lap of said each seal projections 11 and 12 can be mutually carried out easily after a fit-in activity. Therefore, being able to do easily the fit-in activity to the stator 3 of said Rota 4, as well as the case of each invention which was mentioned above also in the above invention [4th] even if it does not use said Rota 4 and stator 3 as a rate form With the lap of said the seal projections 11 and 12 of each, the good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said Rota 4 and stator 3, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between said stators 3 and Rota 4 can be carried out certainly and good.

[0033] Moreover, in the above approach with a group, said stator 3 may be heat-treated instead of cooling said Rota 4. In this case, the diameter can be made to be able to expand so that it may become size from the outer diameter of the 1st seal projection 11 which forms said 2nd seal projection 12 which the method of the outside of the direction of a path is expanded, and forms this stator 3 in this stator 3 in said Rota 4 side with heating of said stator 3, and diameter expansion of said 2nd seal projection 12 can perform fit-in into the stator 3 of said Rota 4. Moreover, by carrying out cooling processing of said Rota 4, and heat-treating a stator 3, it may follow on these cooling processing and heat-treatment, the diameter of said 1st and 2nd seal projections 11 and 12 may be made to reduce the diameter of and expand, and the fit-in activity to the stator 3 of said Rota 4 may be done. Moreover, in the above approach with a group, when said Rota 4 is established in the periphery section of said stator 3, while protruding said 1st seal projection 11 on a stator 3, cooling processing of said stator 3 is carried out, while protruding said 2nd seal projection 12 on said Rota 4, said Rota 4 is heat-treated or only one side

of these cooling processing and heat-treatment is performed.
[0034] Furthermore, the 5th invention relates to the seal approach which could be made to carry out the seal of the shaft-orientations clearance between said stators 3 and Rota 4 automatically using generation of heat produced at the time of operation. This 5th invention like the case of the 1st mentioned above - the 3rd invention to the opposite peripheral face 5 and the opposite inner skin 6 of said Rota 4 and stator 3 The 1st and 2nd seal projections 11 and 12 are formed in the shape of an inconsistency, respectively. The outer diameter D1 of the 1st seal projection 11 11 which protrudes on the opposite peripheral face 5, i.e., the 1st seal projection which protrudes on the peripheral face 5 of Rota 4 arranged inside said stator 3 in the example While forming in a minor diameter from the bore D2 of said 2nd seal projection 12 which protrudes on the opposite inner skin 6 As opposed to Rota 4 where said 1st seal projection 11 protrudes said stator 3 on which said 2nd seal projection 12 protrudes An ingredient with a small coefficient of thermal expansion, For example, said Rota 3 is formed for an aluminum raw material with a large coefficient of thermal expansion etc., and said stator 3 is formed for a nickel system alloy raw material with a coefficient of thermal expansion smaller than said aluminum etc.
[0035] And the 2nd seal projection 12 which was made to carry out expansion diameter expansion of said 1st seal projection 11 which protruded on the peripheral face 5 of Rota 4 by the temperature rise accompanying a revolution of said Rota 4, and protruded on the inner skin 6 of said stator 3 at the time of operation controls diameter expansion expansion, and carries out the lap of these 1st and 2nd seal projections 11 and 12 mutually.
[0036] Since according to the above seal approach the 1st and 2nd seal projections 11 and 12 protrude on said Rota 4 and stator 3 in the shape of an inconsistency and the outer diameter D1 of this 1st seal projection 11 is made into the minor diameter from the bore D2 of the 2nd seal projection 12, As well as the case of each invention mentioned above even if it does not use said Rota 4 and stator 3 as a rate form, the fit-in activity to the stator 3 of said Rota 4 can be done easily. Moreover, at the time of operation As opposed to expansion diameter expansion of said 1st seal projection 11 which protruded on the peripheral face 5 of Rota 4 being carried out by the temperature rise accompanying a revolution of said Rota 4 From expansion diameter expansion of said 2nd seal projection 12 which said stator 3 was formed with the ingredient with a small coefficient of thermal expansion, and protruded on the inner skin 6 of this stator 3 being controlled Can carry out the lap of these 1st and 2nd seal projections 11 and 12 automatically mutually, therefore with the lap of said the seal projections 11 and 12 of each at the time of operation The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said Rota 4 and stator 3, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between said stators 3 and Rota 4 can be carried out certainly and good.
[0037] Moreover, in the above seal approach, when said Rota 4 is established in the periphery section of said stator 3, while protruding said 1st seal projection on a stator 3, said stator 3 is formed for an aluminum raw material with a large coefficient of thermal expansion etc., the 2nd seal projection 12 is made to protrude on said Rota 4, and said Rota 4 is formed in it for a nickel system alloy raw material with a small coefficient of thermal expansion etc. Also when ****(ing), the same operation effectiveness as the case where it mentions above is acquired.
[0038] In addition, although the vacuum pump was explained above as an example of each invention, of course in this invention, it is applicable not only to said vacuum pump but a turbo type fluid machinery etc.
[0039]
[Effect of the Invention] As explained above, with the seal structure of the 1st invention While forming the annular seal projections 11 and 12 which project in the direction of an opposite peripheral surface, respectively in the opposite peripheral face 5 to which said quiescence flank material 3 and revolution member 4 counter mutually, and the opposite inner skin 6 in the shape of an inconsistency While making into a minor diameter the outer diameter D1 of the 1st seal projection 11 which protrudes on said opposite peripheral face 5 from the bore D2 of the 2nd seal projection 12 which protrudes on said opposite inner skin 6 On the other hand, since it formed with the ingredient with a small coefficient of thermal expansion to said another side member 4 which it had opposite inner skin 6 and which had said

opposite peripheral face 5 for a member 3 or 4 or 3 By the aforementioned one side member 3 accompanying the temperature rise at the time of operation, 4 and said another side member 4, or the differential thermal expansion of 3 The lap of said 1st seal projection 11 and 2nd seal projection 12 can be carried out mutually. Therefore, being able to prevent securing a big clearance between the opposite peripheral face 5 of said quiescence flank material 3 and said revolution member 4, and the opposite inner skin 6, and contacting said quiescence flank material 3 at the time of the revolution of this revolution member 4 It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually, the good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of the shaft-orientations clearance between both [these] the members 3 and 4 can be carried out certainly and good. Moreover, since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter with the above seal structure rather than the bore D2 of the 2nd seal projection 12 in which it is prepared by the opposite inner skin 6 of said quiescence flank material 3, When [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, Without checking said another side [as opposed to a member 3 or 4 on the other hand] member 4, or fit-in of 3, said each seal projections 11 and 12 can ensure this one side member 3, the another side member 4 of 4, or fit-in of 3, and can also do an activity with a group easily. Furthermore, in the above invention [1st], said quiescence flank material 3 and revolution member 4 are divided in the die-length direction at plurality, respectively, and although the lap of the seal projection which prepared each of this division member in this each division member in the shape of a laminating at the time of assembly is carried out mutually, an activity with a group is not complicated like, and fluid leakage does not occur from the laminating clearance between said each division member.

[0040] Moreover, since [which had the opposite inner skin 6 among said both members with the seal structure of the 2nd invention] the cooling means is formed in a member 3 or 4 on the other hand, At the time of operation, cool said one side member 3 or 4 with this cooling means, and this one side member 3 or the thermal expansion of 4 is controlled. By making thermal expansion cause by the temperature rise at the time of operation at said another side member 4 or 3 side, and on the other hand, generating a big differential thermal expansion between these one side member 3, 4 and the another side member 4, or 3 While the big clearance which may be made to carry out the lap of said each seal projections 11 and 12 certainly mutually, therefore does not contact between said quiescence flank material 3 and revolution members 4 is securable It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out much more certainly and good. And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of the 1st invention mentioned above, Without using the quiescence flank material 3 and the revolution member 4 as a rate form When [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, Without said each seal projections 11 and 12 checking fit-in, the aforementioned one side member 3, the another side member 4 of 4, or fit-in of 3 can be ensured, and an activity with a group can also be done easily.

[0041] Furthermore, with the seal structure of the 3rd invention, on the other hand, while forming with an ingredient with a small coefficient of thermal expansion to the another side member 4 which had the opposite inner skin 6 among said both members and which had the opposite peripheral face 5 for a member 3 or 4, or 3 Since [with said opposite inner skin 6] the cooling means is formed in a member 3 or 4 on the other hand, At the time of operation, the aforementioned one side member 3 or 4 is cooled with this cooling means. Moreover, since [this] a member 3 or 4 is formed with the ingredient with a small coefficient of thermal expansion on the other hand, This one side member 3 or the thermal expansion of 4 can be controlled much more good. In said another side member 4 or 3 side Thermal expansion will happen by the temperature rise at the time of operation, and a big differential thermal

expansion is generated between these one side member 3, 4 and the another side member 4, or 3. While the big clearance which may be made to carry out the lap of said each seal projections 11 and 12 certainly mutually, therefore does not contact between said quiescence flank material 3 and revolution members 4 is securable It becomes possible to carry out the lap of said 1st and 2nd seal projections 11 and 12 mutually. The good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out much more certainly and good. And since the outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 is made into the minor diameter like [bore / D2 / of the 2nd seal projection 12 prepared in said opposite inner skin 6] the case of each invention mentioned above When [said], fitting in and attaching the another side member 4 or 3 to a member 3 or 4 on the other hand, said each seal projections 11 and 12 cannot check fit-in, the aforementioned one side member 3, the another side member 4 of 4, or fit-in of 3 can be ensured, and an activity with a group can also be done easily.
[0042] moreover, by the approach with a group of the seal structure concerning the 4th invention The outer diameter D1 of the 1st seal projection 11 prepared in said opposite peripheral face 5 rather than the bore D2 of the 2nd seal projection 12 in which it is prepared by said opposite inner skin 6 A major diameter and nothing, While it had the opposite peripheral face 5 among both [these] members at the time of fit-in to the quiescence flank material 3 of said revolution member 4, cooling processing of a member 3 or 4 is carried out. Or the another side member 4 with the opposite inner skin 6 or 3 is heat-treated. Since it follows on these cooling processing or heat-treatment and he is trying to make the diameter of said 1st seal projection 11 and 2nd seal projection 12 reduce the diameter of or expand by [said] on the other hand cooling and heat-treating a member 3, 4 and the another side member 4, or 3, respectively [both], In spite of making the outer diameter D1 of said 1st seal projection 11 into the major diameter rather than the bore D2 of said 2nd seal projection 12, the aforementioned one side member 3, the another side member 4 of 4, or the fit-in activity of 3 can be simplified by performing above cooling and heat-treatment. And the aforementioned one side member 3 by which cooling processing was carried out after the fit-in activity, or 4 is returned to ordinary temperature. Or by returning said heat-treated another side member 4 or 3 to ordinary temperature Like the case of each invention which could be made to carry out the lap of said each seal projections 11 and 12 simply mutually, therefore was mentioned above, being able to do easily the fit-in activity over the quiescence flank material 3 of said revolution member 4 With the lap of said the seal projections 11 and 12 of each, the good labyrinth effectiveness is acquired between said opposite peripheral face 5 and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out certainly and good.
[0043] Furthermore, by the seal approach concerning the 5th invention, the respectively annular 1st and 2nd seal projections 11 and 12 are protruded on said opposite peripheral face 5 and opposite inner skin 6 in the shape of an inconsistency. While forming the outer diameter D1 of this 1st seal projection 11 in a minor diameter from the bore D2 of the 2nd seal projection 12 On the other hand, it forms with an ingredient with a small coefficient of thermal expansion to the another side member 4 which had the opposite inner skin 6 among said both members and which had the opposite peripheral face 5 for a member 3 or 4, or 3. In order to carry out the lap of said 1st seal projection 11 and 2nd seal projection 12 by the temperature rise produced at the time of the revolution of said revolution member 4, Like the case of each invention mentioned above, being able to do easily the fit-in activity over the quiescence flank material 3 of said revolution member 4 The lap of said each seal projections 11 and 12 can be automatically carried out at the time of operation, the good labyrinth effectiveness is acquired between the opposite peripheral face 5 of said quiescence flank material 3 and revolution member 4, and the opposite inner skin 6, and the seal of said both members 3 and the shaft-orientations clearance between four can be carried out certainly and good.

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* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is an explanatory view explaining each invention.
[Drawing 2] It is an explanatory view explaining the 4th invention.
[Drawing 3] It is drawing of longitudinal section of the vacuum pump shown as an example of application of each invention.
[Drawing 4] It is drawing of longitudinal section showing the conventional example.
[Description of Notations]
3 Quiescence Flank Material (Stator)
4 Revolution Member (Rota)
5 Opposite Peripheral Face
6 Opposite Inner Skin
11 1st Seal Projection
12 2nd Seal Projection
D1 Outer diameter
D2 Bore

[Translation done.]

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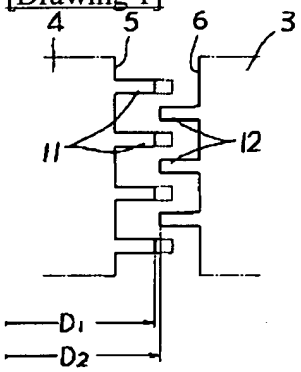
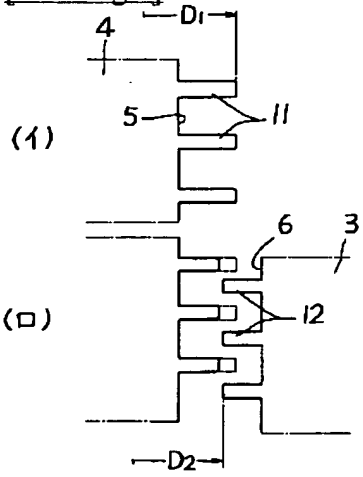
DRAWINGS

[Drawing 1]



3：静止側部材（ステータ）
4：回転部材（ロータ）
5：対向外周面
6：対向内周面
11：第1シール突起
12：第2シール突起
D1：外径
D2：内径

[Drawing 2]



[Drawing 3]

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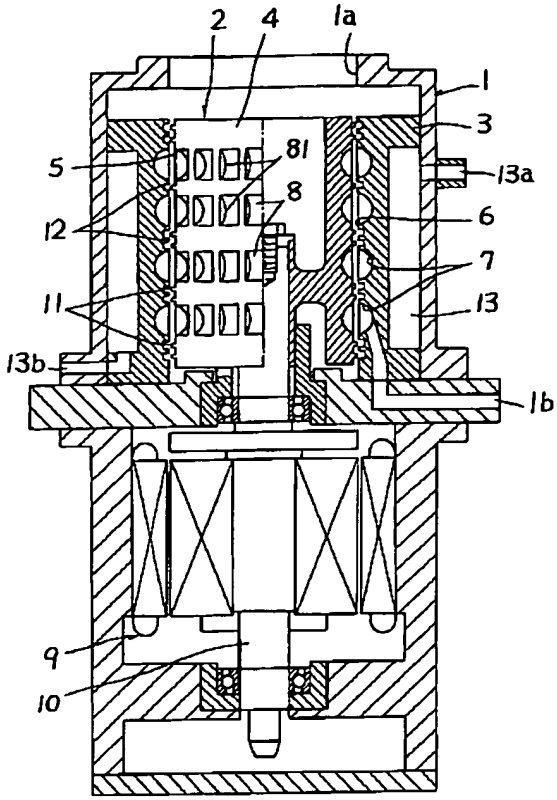
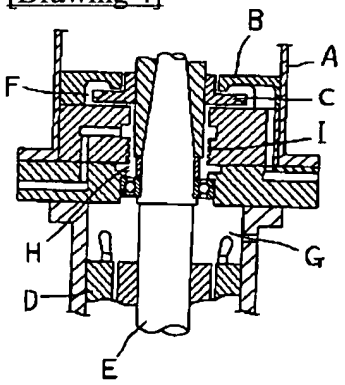


[Drawing 4]



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